Abstract

This thesis deals with the modelling, simulation and control of Permanent Magnet Synchronous Machines (PMSM) used specially in electric and hybrid vehicles. With the availability of fast semiconductor switches and high speed processors, Vector controlled drives are gaining popularity. One disadvantage of this type of control however, is the need for high cost, high resolution sensors (encoders) for determining the rotor position. Position sensorless schemes have evolved over a decade and this thesis addresses this issue.

Two schemes have been proposed for the elimination of encoders in vector controlled drives. One is a semi-sensored scheme wherein a combination of low cost hall sensors and a digital position estimator gives the position information. In the second scheme, a reduced order observer called Luenbuerger observer has been used to estimate speed and rotor angle. The problem of finding rotor angle at standstill has also been dealt with. This thesis also discusses the difference in simulating a BLDC (Brushless DC) and PMSM machine.

An experimental set-up consisting of MOSFET inverter and TMS320LF2407 DSP based digital controller was developed in the laboratory to implement the control algorithms. Two PMSM machines were procured from a two-wheeler manufacturer to set up the rig. Simulations were done in MATLAB/ Simulink (Off-line) and Xilinx XC3S400 (in real-time) to verify the concepts. Simulation and experimental results are finally compared.